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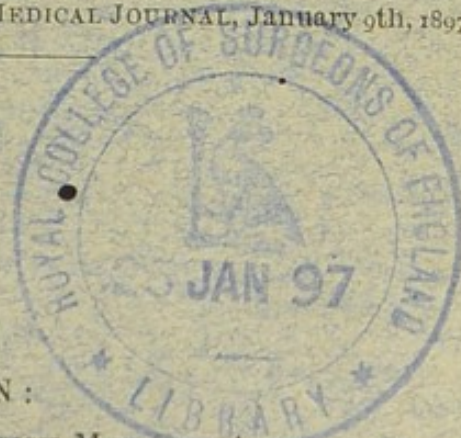
THE POSSIBILITY OF THE
ACCLIMATISATION OF EUROPEANS
IN TROPICAL REGIONS.

BY

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ROME.

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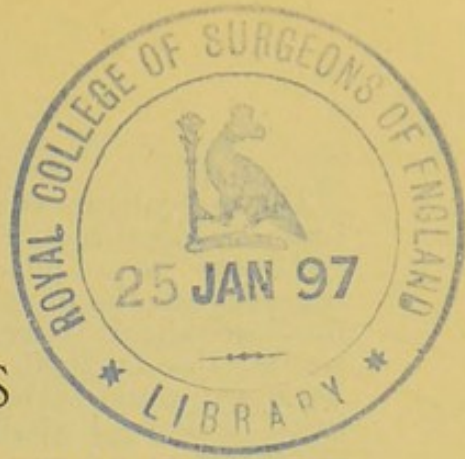


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REMARKS

ON

THE POSSIBILITY OF THE ACCLIMATISATION OF EUROPEANS IN TROPICAL REGIONS.

THE question whether Europeans can become acclimatised in tropical regions is one of great interest now that all European states look upon the development of the Dark Continent as the means of relief of the overcrowding of their populations, and of securing new markets for the produce of their industries.

There exists a wide difference of opinion on the question, but the almost universal agreement is that complete acclimatisation of Europeans in the tropics is impossible. Such a pessimistic view is derived mainly from the fact that, up to thirty years ago, the comparison of statistics, in all tropical countries, proved decidedly unfavourable to European colonisation. The enormous death-rate, tenfold higher for the European than for the native, seemed to prove, beyond doubt, that in the struggle for life, in tropical regions, the European was defeated.

The death-rate of Europeans in tropical countries has greatly diminished of late years through rational hygiene and sanitation; but, independently of more favourable statistics, if the question of acclimatisation be studied in its true elements, and if facts be rightly apprehended, a very different conclusion is attained, as in this paper I shall endeavour to prove.

THE DEATH-RATE.

If we compare the death-rate of England (19.2) with that of the West Coast of Africa, which has been called "the grave of the white man," we shall certainly find a striking contrast, but tropical regions vary greatly in their salubrity, and some will compare favourably with that of England. Thus, in Curaçao (Lesser Antilles) the average annual death-rate is 18.7 (1881-85); in Jamaica, 22.2 (1888); in Guiana, 27.4 (1881). Moreover, the death-rate of European States also differs widely, as, for example, between Norway (16.8) and Russia (35.4).

But in comparing tropical countries to European States we must not forget that the health of Europe is greatly due to the enactment of judicious public health laws, to great sanitary works, to more appropriate modes of life, and above all to the consideration which has fairly established itself in the public mind that disease is largely preventable. No country perhaps has benefited more from sanitary science than England, which can justly boast of having been its cradle. Consider what a difference in the healthiness from the Elizabethan to the Victorian age notwithstanding the increase of population from 4 to 29 millions!

THE INFLUENCE OF HEAT.

The unhealthiness of tropical countries is universally attributed to the direct influence of their climate, but the term "climate" is not generally understood to mean all surroundings, nor all the physical conditions of a place, not even all meteorological agencies, but only temperature; or, in other words, the tropical climate is considered inimical to the European constitution because of its greater and continued heat. I hope I shall be able to show that this notion is erroneous.

Of course climate acts upon the human constitution as on animal life in general and temperature is certainly one of the most important of all climatological factors. A striking example is the change in hair which takes place in the wool of European sheep imported to the West Indies or to the West Coast of Africa, but the effects of climate on the body have little to do with the unhealthiness of tropical countries. Animal life responds to the influences of surroundings by changes essentially protective. A convincing example of this marvellous process of adaptation is that of a gull (*Larus argentatus*) of the Shetland Islands, which twice every year changes the structure of its stomach according to its food. During the summer it feeds on grain, and has the gizzard of a graminivorous bird; during the winter it feeds on fish, and the gizzard is transformed into a carnivorous stomach (Edmonstone).

In considering the effects of climate and surroundings we must be very careful not to confound the changes brought on by adaptation with those consequent on disease. If, for instance, the anæmic state¹ due to the destruction of the red blood corpuscles by the protozoa of malarial diseases be considered as a normal and protective condition due to heat,² as some authors³ have advanced, no wonder that the tropical climate must appear most injurious.

Heatstroke is universally looked upon as the most obvious effect of great heat, but I believe it to be an infectious disease due to a specific organism whose natural history is strikingly similar to that of the tetanus bacillus. The symptoms of the disease, its morbid anatomy, its peculiar geographical distribution, its epidemic occurrences, the relative immunity to its attacks afforded by acclimatisation, the conditions under which it prevails, all clearly point to the specific infectious nature of the disease.

All forms of liver affections may be met with in hot countries, but when they occur in the tropics they are curiously attributed to heat. Liver abscess in tropical countries is far more frequent than in temperate regions; but when we consider the great disproportion of its occurrence in different parts of the world where the same climatic conditions exist,⁴

¹ A frequent cause of anæmia in most tropical countries is the *ankylostoma duodenale*. Professor Sonsino says: "It is a veritable scourge, and is decimating slowly and deteriorating entire populations like malaria."

² We know from the observations of Marettang, Eykman, and others, that in tropical regions the composition of the blood undergoes no change in the amount of red corpuscles or hæmoglobin under the influence of high temperature or other meteorological agencies.

³ Sir William Moore, Treille.

⁴ European troops suffer much more from liver diseases in India than in the West Indies and other hot countries (Fayrer). Hepatitis and liver abscess are far more frequent in Madras than in either Bombay or Bengal, and the same excess in Madras has always been known (Cayley).

and its great diminution with improved hygienic surroundings in places where it was most prevalent, we must believe that it cannot be attributed to mere heat, moisture, or sudden alterations of temperature, but far more likely to the dysentery amœba (*Kartulis*).

On inquiring as to the effects of heat on human beings, we find that very high temperatures can be tolerated without harm. In the dry regions of Arizona and South Colorado the ordinary avocations of farm and factory are pursued without inconvenience in temperatures of 118° to 128 F. (Greely). Europeans have lived in health and cheerfulness on the banks of the Senegal when the thermometer in their tents stood at from 120° to 130° F. The tea planters of Assam furnish a remarkable illustration of the safety with which Europeans may expose themselves in the hottest sun. Tea planters are a large class, and their duties require them to be out in the hottest season and at the hottest time of the day (De Renzy). It is, indeed, surprising what power the human frame possesses of resisting the effects of high temperature. Many of our workmen, such as metal casters, glass blowers, furnace men, stokers working on board ship,⁵ and men employed in Turkish baths are exposed for hours together to far greater heat than ever emanated from a tropical sun.⁶

There is, unfortunately, a complete lack of statistics that might show the effects of long-continued exposure to intense heat upon such workmen. Usually they are thin, and more or less pallid; but we must remember that also in these cases heat is not found acting alone, but with many other unhygienic conditions, such as noxious gases, vapours, and dust, besides the heavy and exhausting labour, and the very free indulgence in strong drink to allay their painful thirst while working. But if workers exposed to intense heat occupy a low place in tables of vital statistics, it is certainly not from the diseases most prevalent in hot countries. Diseases of the circulatory system and pulmonary affections, rheumatism, lumbago, and sciatica are among their most distinctive ailments.

In some of the hottest seasons in tropical countries the death-rate may rise greatly, but such a coincidence must not be taken as a proof that heat is the cause of unhealthiness. In the summer of 1895, in Bengal, when the temperature in the shade was as high as 115°, the death-rate rose to nearly 50 per 1,000 in the towns of Burdwar and Hoogley, and to 58 per 1,000 in Calcutta. But it was lower than normal in rural Bengal, thus showing that it is not heat that kills, although it may greatly favour unhealthy conditions.

The European transferred to the tropics accommodates himself to the greater and continued heat in a remarkable manner; the lungs act less, the skin more, the circulation

⁵ Stokers on large steam vessels are subjected to intense heat and to coal dust, often in horribly ill-ventilated and dark stoke holes. They work in a temperature of over 150°, sometimes for so long as four hours without harm. Formerly confinement in the stokehole was a common punishment at sea.

⁶ Tillet states that the female assistants in the bakeries of La Rochefoucauld entered the oven at a temperature of 301.6° F. The workmen of Sir F. Chantrey were accustomed to enter a furnace in which his moulds were dried whilst the floor was red hot, and a thermometer in the air stood at 350° F.; and Chabert, the Fire King, was in the habit of entering an oven the temperature of which was from 400° to 600° F. (Carpenter). Of course such extremes of temperature can only be endured for a short time and provided the action of the skin be free.

lessens, the individual as a rule becomes thinner, and he soon differs in no essential point from his tropical brother. These variations are the same which take place in the inhabitants of the temperate regions during the height of summer.

CAN CHILDREN THRIVE?

An argument often brought against the possibility of European acclimatisation in the tropics is the old and persistent impression that the tropical climate is extremely fatal to European child life. Certainly infant mortality is very high in some parts of India and in several other tropical localities, but in such places it is always much lower among European children than among natives.

In Calcutta, where it is extremely high, 58 European infants die annually out of every 1,000 born, whilst the mixed races lose 306 per 1,000, the Hindus 315 per 1,000, and the Mohammedans 363 per 1,000 (Payne).

The chief cause of this remarkable excess amongst the natives of Calcutta is tetanus, a preventable disease of bacillary origin.⁷

Infantile mortality varies greatly in different tropical countries, just as it does in Europe, where it ranges from 41 per 1,000 in Norway to 113 per 1,000 in Italy (Farr). In some mining districts in England 270 infants under 1 year die annually out of 1,000 born.

Some persons admit that infants can thrive in India up to 5 or 6 years, but between this age and fully-developed manhood they consider the climate absolutely inimical. It is true that most European children brought up in India grow up slight, weedy, and delicate, but this is easily explained because Europeans in India are generally obliged to settle in the very hotbeds of disease, and the normal development of their children must surely be hindered by inherited defects and frequent illnesses; besides, for the fear of diseases, wrongly attributed to solar influence, European children are constantly shut up in stuffy and darkened houses. Under similar conditions they grow up no better in Europe.

Experience has proved that, under proper hygienic conditions and careful management, the European child, whether born in India or imported from England, may live and thrive "almost as well as in Europe" (Sir J. Fayrer).

DETERIORATION NOT DUE TO CLIMATE.

It is also a common belief that Europeans cannot permanently maintain themselves in the tropics without deteriorating.

Some years ago it was likewise believed that the English in the United States and in Australia must inevitably degenerate (Dr. Knox). We know now that the transplanted English in America and Australia have not only not degenerated, but that they, leading a healthy outdoor life, have improved their physique. It is not so much in the colonies as in their own climatic home that the English are deteriorating. Broad chests and powerful limbs are no longer common among labourers and artisans (Dr. Stewart). The medical examiners of recruits reject a larger proportion every year, and those admitted into the ranks are certainly inferior to their predecessors (Dr. Beddoe). This deterioration⁸ is attributable to the herding together of dense masses of population in large cities⁹; to a more strenuous struggle for existence; to alcoholism, immorality, syphilis, and tuberculosis; to the survival of the unfit. It has been claimed that the strongest blood

⁷ The proportion per cent. which tetanus constitutes of the total infant mortality among the different races is as follows: Europeans 15, mixed races 15, Hindus 44, Mohammedans 43 (Dr. McLeod).

⁸ The same is, to a greater or lesser extent, the case in Paris, Berlin, New York, and other large cities.

⁹ According to Dr. Farr, the mortality of districts increases with the density of their population.

cannot endure continuous city life for more than three generations,¹⁰ but must be kept alive by the infusion of country blood, or by return in some degree to country life (Dr. Taylor). It is impossible to trace how far marriage supplies an admixture of new blood into the worn-out city stock, but the constant immigration of country folk of both sexes into our large towns is a well-known fact. In almost all nations, organic ruin is slowly progressing as the old country life is being merged into the miserable life of cities. The birth-rate in England, France, Germany, Holland, and Belgium shows a marked decline coincident with the increase of urban population; and, if we compare the mortality of the rustic labourer with that of the corresponding class in towns, we find that the countryman enjoys a life on an average three times as long as that of his metropolitan brethren. It is surely over our cities that Dante's inscription, "*Lasciate ogni speranza voi ch' entrate*" might have been written.

Deterioration, whether in our towns, in the unhealthy districts of Europe (goitrous and malarious districts), or in tropical colonies, is evidently not due to meteorological agencies, but is the consequence of infectious disease. Tuberculosis and malaria are the most common and best types of degenerative action and loss of vital energy.

CAN EUROPEANS WORK?

Another argument often stated is that if Europeans wish to live in tropical countries they must be free from outdoor physical labour and certainly over-exertion in an unhealthy locality may prove fatal, but experience in all tropical regions has proved that Europeans are far more healthy when taking regular exercise.

In malarious countries, the breaking up of the soil is always dangerous.¹¹ The Boers, who thrive as herders, would probably suffer were they to stir up the soil as husbandmen. In India, while the tea planters of Bengal, excepting those resident in the hills, are sickly in appearance, the indigo planters of Tirhoot, who expose themselves at all seasons and take a great deal of exercise in the sun, retain more of their healthy European appearance than the settlers in other parts of India. It has been remarked by Dr. Jackson that in the East and West Indies European troops were never so healthy as when actively engaged under solar influence and never so sickly as when reposing in barracks. De Quatre-fages has pointed out that in the West Indies the wealthy and idle creoles and not the "*petits blancs*" swell the death-rate of the white population above the average. The transplanted English in tropical Australia work out of doors without loss of energy. When the slaves were emancipated in Guiana planters sought relief in various directions. Negroes from the islands, Indian coolies, Chinamen were all tried, but collapsed. At length they got labourers from Madeira who proved to be efficient, but, more hands being wanted, Portuguese were introduced with results as satisfactory as surprising, they worked better than negroes and they did not suffer more from the climate (Boyle).

NO RACIAL IMMUNITY.

In unhealthy tropical localities sickness and death-rate are quite as bad among natives as among Europeans. There are differences of prevalence due to differences in the mode of living, but no racial immunity as was formerly supposed.

The immunity of the coloured races from malaria was once considered as an indisputable fact. More recent observations have proved that differences are usually small and mostly unfavourable to the natives.

Comparing the relative prevalence of fever in the European and native troops in India, we find that in the ten-years period 1878-1887, while the admission-rates were equal, the death-rates were three times higher for the natives. In the epidemics of malaria which prevailed in the Island of Mauritius after 1867 the population that suffered most was the immigrant Indian population, and that which suffered the least was the immigrant European (Davidson).

¹⁰ Boudin could not find any pure Parisians who could trace the residence of their ancestors in the city back for more than three generations.

¹¹ The danger of turning up the soil and exposing it to sun and showers has often been exemplified. There was a great outbreak of malarial disease in Paris when the canal St. Martin was excavated. A most fatal fever devastated Hong Kong when the hill behind the city (Victoria) was broken up for building purposes.

On the other hand, it is frequently stated that the dark races are more liable to elephantiasis than the white. This is undoubtedly true in some countries in which Europeans live a more hygienic life and are more careful about the water they drink. But when whites assume the habits of the natives, they are quite as liable to acquire elephantiasis, as Indian and Brazilian experience has proved (Manson). In India European soldiers suffer much more from liver diseases than the natives, but this is probably due to the great consumption of alcoholic drinks among white troops.

It is a well-known fact that native soldiers suffer much more than European soldiers from all kinds of diseases when they pass from their own district to another within the tropics (Dr. Bryden). But it seems only right to say that the natives are much more exposed.

GEOGRAPHICAL DISTRIBUTION OF DISEASE.

Although the death-rate of widely separated tropical regions may be very much the same, the diseases which cause it are generally different in the various localities. Diseases have well-defined geographical limits, and, whether due to micro-organisms or to higher forms of organic life, their distribution has been regulated by the same laws which have caused the dispersion of all plants and animals.

Some tropical diseases have a very extensive diffusion, and are also endemic in temperate regions; but the majority have narrow endemic limits, even if, like cholera, they have at times vast epidemic diffusion.

Dysentery and malaria have the widest distribution, but districts quite close to each other and under the very same climatic conditions suffer very unequally from either disease. Very often malaria and dysentery are endemic in the same region, but in many places where the one is prevalent the other is unknown. Malarial fevers are essentially connected with marshy soil.

The plague, which in past times spread widely, seems to have its foci in the neighbourhood of Benghazi in Tripoli; in the district of Assir, on the Western Coast of Arabia; and in localities in Mesopotamia, Persia, Hindustan, and Southern China; but it has never appeared in the Southern Hemisphere or the New World.

Elephantiasis arabum (*filaria nocturna*, Manson) has a wide area of distribution all over the tropical and sub-tropical world; but some localities are far more affected than others, whilst it is entirely absent in many islands within the endemic zone, as for example in Formosa.

Beri-beri has likewise a wide distribution in many tropical countries, and is at times epidemic, but it is strictly limited in its endemicity.

Yellow fever may become widely diffused in great epidemics, but its endemic area is restricted to the West Indies, the shores of the Gulf of Mexico, and to certain portions of the West Coast of Africa. It is essentially a disease of the sea coast and of the banks of great rivers; its altitude range has rarely exceeded 1,000 feet.

Endemic hæmaturia (*bilharzia hæmatobia*) has a very limited area of distribution in Africa and Mauritius.

Madura foot is limited to places in India.

Negro lethargy (*filaria prestans* (?), Manson) is confined absolutely to the West of Africa, and in its endemic area it prevails only in particular localities.

Verruga is confined to some valleys of the Peruvian Andes.

INCREASE AND DIMINUTION OF DISEASES IRRESPECTIVE OF CLIMATE.

In all tropical countries each district maintains its natural peculiarities of climate and soil year after year, and should, if these conditions be potent, give its yearly quatum of malaria, dysentery, enteric fever, etc.; and in corresponding ratio, district for district, with the intensity of these conditions, yet statistics furnish no support to this necessary sequence; on the contrary, while some diseases have diminished, others have increased quite irrespective of climatic conditions. Cholera has greatly decreased in India wherever a pure water supply has been introduced. Enteric fever has become far more prevalent.

The mortality from enteric fever in 1894 was nearly three times what it was in the decade 1870-79. This increase has been attributed by some authors to change of nomenclature and mistaken diagnosis, but such

explanations are not tenable. Dr. Welch has shown that in many places the introduction of a faulty drainage in place of cesspools has been a favourable condition to the spread of the disease, and he has also pointed to the fact that the increase is closely connected with the greater number of young soldiers arriving in India owing to the introduction of the short service system. The age of these soldiers—the enteric fever age, as Duka calls it—makes them especially liable to the infection, and consequently the spread of the disease is favoured by the greater number of cases.

INTRODUCTION OF NEW DISEASES.

The healthiness of some tropical regions has been completely changed by the introduction of diseases which had never existed in them before, but had more restricted areas in other tropical localities.

The chigger (*pulex penetrans*), which formerly was confined to Central America and the West Indies, was introduced into Africa in 1872 or 1873, and has spread over the greater part of that continent with incredible rapidity.

Malaria was introduced in quite recent years into the islands of Mauritius and Reunion, which are believed to have been formerly free from infection. Near to Mauritius, now an intense focus of malaria, there is the island of Rodriguez, under the same climatic conditions, which remains free from the infection.

A striking example of the effects of introduced diseases is that of the Hawaiian people who, within a century, have been reduced to nearly one-fifth of their number by the introduction of syphilis and leprosy.

TROPICAL DISEASES ARE LAND AFFECTIONS.

Tropical diseases are characteristically land affections. The crews of ships sailing in tropical latitudes are strikingly exempt from them, although placed under unfavourable circumstances, due to the small amount of air space available between decks and to a dietary largely consisting of preserved foods. When tropical diseases do occur among seamen they have generally been contracted on shore or introduced on board ship by means of food, drinking water, or other supplies. Sometimes, when ships are obliged to anchor off unhealthy shores, disease is spread to them by the wind. Ships may become independent centres of disease, and often convey diseases from one country to another as they convey brown rats (*mus decumanus*), which, finding their way into almost every ship, land in almost every shore. Many times yellow fever was brought by ship to the United States, and cholera to Europe, and often they developed into dreadful epidemics, although under physical conditions very different to those of their habitat.¹²

Owing to the great improvements made of late years in regard to supplies of drinking water and to the more extended use of distilled water, diseases such as enteric fever, dysentery, and diarrhoea have greatly diminished in frequency. When they do occur in the naval service they invariably are found to have been derived directly from the shore.

LIFE PREYING UPON LIFE.

It is not the mere influence of climate which opposes colonisation in tropical lands, but the competition of other living organisms—from man, wild beasts, and snakes to protozoa and bacteria—with which we have to struggle for existence.

In India about 23,000 people and 60,000 head of cattle are killed every year by snakes and wild beasts, but no one would think of putting those deaths down to climate. In Iceland one-tenth of all deaths are due to echinococcus disease, but

¹² Deadly epidemics of cholera occurred in Russia during the winter.

even in this case no one would attribute to climate the ravages of the tiny cestode. Why, then, should we make climate responsible for the mortality caused by other organisms, even though they be the lowliest in the scale of life and invisible to the naked eye? The greatest advance in scientific medicine from the earliest times is undoubtedly the demonstration that diseases belong to the domain of parasitism.

CLIMATE AND DISEASE.

Although climate *per se* is not injurious to health, it has nevertheless an important rôle in the development and spread of disease.

In some years conditions of environment are so very favourable to some pathogenic micro-organisms that, on account of an unchecked multiplication, they swarm and spread far out of their endemic areas. It happens with bacteria as with some insects—locusts, for instance—which, at certain times, under very favourable circumstances, swarm in those awful pests which are so much dreaded by the farmers of Africa.

We must admit of an even more direct influence of climate in predisposing to disease or influencing its progress.

A very damp atmosphere will develop latent tuberculosis of the throat and lungs, and will favour the continuance of catarrhal affections of the air passages, because it acts directly on the micro-organism and on the tissues, which have become their feeding ground.

The skin in new arrivals in the tropics, being stimulated to increased secretion, is continually bathed in perspiration, and readily becomes subject to lichen tropicus.

INFLUENCE OF HABITS AND CUSTOMS.

But certainly far more powerful factors in rendering the body vulnerable to the action of disease are the foolish continuance of unsuited habits and customs of European life, the errors of clothing and diet, the neglect of all principles of hygiene.

The customs and vices of our civilisation have greatly increased consumption among the American Indians in their own climatic home, as Dr. Mathews, of the United States Army, has proved. At the beginning of the eighteenth century the Red Indians in the United States were over 2,000,000; in 1880 only 253,000. The same causes have reduced the population of Tahiti from 240,000 to 7,000, and that of New Zealand from 500,000 to 30,000.

But, although many different conditions can predispose to diseases, these cannot be contracted unless the specific micro-organisms peculiar to each be present.

THE ARMY EXPERIENCE.

The annual mortality of European troops in India stood at 69 per 1,000 for many years prior to 1859. A Royal Commission sitting in 1864 ventured to express a hope that the introduction of scientific sanitation might reduce this to 20 per 1,000. This estimate was even too modest, for now it is as low as 12 per 1,000.

Still more striking is the change which has taken place in the West Indies, where service was formerly considered as almost certain death. Now, in some stations, as for example Trinidad and Barbadoes, the sickness and mortality among the European soldiers are actually less than on home service in years which have no yellow fever.

It may be objected that the lessened sickness and mortality of English soldiers in the tropics is owing to the shorter period of service, but the actual service is never less than five years, and we know that the death-rate and morbidity

have always been greatest in the first two years. Moreover, "as the whole long service was constantly passed under the unfavourable sanitary conditions now removed, it does not follow that the inference to be drawn from the statistical evidence as to length of service is really correct" (Notter).

Again, the soldiers now transferred to India are mere boys, their ignorance of what to avoid is complete; their carelessness proverbial. Under equal conditions they would fall victims to disease in numbers greatly in excess of the more mature and longer service men.¹³

A marked example of the influence of age susceptibility was the 32nd Regiment in Mauritius with malarial fever, when the proportion of attacks per 1,000 of strength under 20 years of age was 250, while between 20 and 30 it was only 40.82.

The almost incredible reduction in mortality obtained in tropical colonies through improved sanitation, a greater knowledge of local diseases, and more appropriate customs proves that the causes which induce disease and shorten life in the tropics are, as in Europe, greatly under our own control.

DISTRIBUTION OF LIFE.

According to popular belief each species of animal or plant originated in the area it now occupies, but we know that the surface of the earth has continually changed. Land has sunk beneath the ocean, fresh land has risen up from it destitute of land-life; mountain chains have been elevated, altered, crumbled; the physical conditions of districts have been entirely modified; organic life has therefore been subject to continuous displacement and alteration.

If we inquire into the origin of our domestic animals, we shall find that twelve of them came from Asia, two from Africa, and three from America, while only five are European.

As to cultivated plants we should be very poor indeed if we were left only with those natives of Europe. Lemons and oranges were not cultivated in Italy when Pliny wrote; juicy peaches were not grown in Greece in the time of Aristotle. Thousands of people in Europe almost depend entirely on one of our last importations—the potato: it was introduced in England by Sir Walter Raleigh in 1598, and in 1894 it covered an area of 1,232,055 acres in England alone, which gave 4,662,147 tons of potatoes.

Again we have successfully acclimatised in America and Australia the animals and plants which had previously been acclimatised in Europe from Asia and Africa.

There were no sheep in America and Australia; now their number is simply countless. Horses and cattle have thriven marvellously in South America; in New South Wales horses have turned wild and have increased with alarming rapidity.

Even more incorrect is the theory that each species occupies those districts or surroundings best suited to its life. Often species introduced from one country to another or from one climate to another have proved better adapted to the new conditions than to those of their original habitat and have flourished and increased to such an extent as to exterminate the indigenous inhabitants.

The rabbit introduced into Australia and New Zealand and the sparrow in New Zealand and the United States, have found conditions so favourable in their new homes—abundant food, no competition—that, with amazing rapidity, they have grown into pests of appalling proportions.

¹³ It may be well to mention that the diseases which most affect the health of European soldiers in India are not those peculiar to a tropical climate, but venereal diseases and enteric fever. In the Government of India sanitary report for 1892, we find that the European army gives 410 admissions for venereal diseases to every 1,000 of its strength. While venereal diseases cause the bulk of the invaliding, enteric fever is pre-eminently the disease which causes the largest death-rate (3.52 per 1,000).

The thistle, introduced into Australia by a Scotch emigrant, some forty years ago, has spread all over the country, proving a deadly foe to the Colonists. The watercress has proved equally injurious, choking up all the rivers of the country (Dr. Hooker).

A native proverb of New Zealand says, "as the white man's rat has driven away the native rat, as the European fly drives away our own, and clover kills our fern, so will the Maoris disappear before the white man himself." (Youmans).

Some animals and some plants when first introduced into a new country seem unable to thrive, but we must not rush too hastily to the conclusion that the new climate is not suitable. If we could only know all the facts which bear on the case, we should probably find the reason to be a very different one.

The red clover would not grow in New Zealand until bumble bees were introduced to fertilise its flowers; now it displaces the native grasses.

Very few of our hardy garden plants ever run wild. Botanists have sown the seeds of many hundreds of species of exotic hardy plants in what appeared to be the most favourable situations, but in hardly a single case has any one of them become naturalised. This proves that the competition of other organisms is a far more efficient agency in limiting their distribution than the mere influence of climate.

DISTRIBUTION OF MAN.

No plant and no animal originated in all the regions of the globe, and man, anatomically and physiologically a mammal, must have had likewise a restricted primary area. To suppose that man appeared in the beginning, everywhere that we now see him, would be to make a unique exception of him; therefore, even in the absence of direct proof we should have to admit it or otherwise deny all the general laws of geographical distribution. However, it is an undisputed fact that widespread migration and consequent acclimatisation took place in all times and the researches of ethnologists to-day are continually bringing new evidence.

The whole history of mankind is one of invasions and displacements; one restless movement of individuals and masses.

The swarms of colonies thrown out by Phœnicia and by old Greece, the Slavonic and Teutonic floods which burst into the Roman Empire in the fifth and sixth centuries of our era and the swaying to and fro of the vast Mongolian hordes in more recent times are good examples.

Formerly, the several races¹⁴ of mankind were considered quite distinct ethnic groups and were believed to have originated independently of each other, in the areas where they are now found, but now the unity of the human species has become an accepted fact, and we know that "races are the daughters of climates," as Hippocrates said more than two thousand years ago.

In following up the history of some of the migrations of men which moved only a few centuries ago far from their ancient seats, we find that they have fallen under the same laws which govern the dispersion of all organic beings, according to circumstances, more or less favourable, while some people have hardly changed in their new settlements, and have succeeded so well that they have displaced or pushed wholly out of existence the former occupants, others have been transformed in various degrees by the new conditions of life, and by mixing and crossing with local people: others have totally disappeared.

¹⁴ The human races varied in number according to authors from three (Cuvier) to fifteen (Borid de St Vincent).

Thus in India, while the Rohillas, the Rajpoots and the Parsis of Aryan race, after centuries have remained unchanged, the Portuguese of Bombay and Goa have changed immensely, and are now as black as Kohls or Bhils (Boyle).

But if Aryans of remote immigration have not only been able to thrive, but have even absorbed the Semitic dwellers of India, why should the Aryan of to-day be unable to prosper even in those parts of the country which have been called "the English climates of India?"

The French thought at one time that they would never be able to thrive in Algeria,¹⁵ although descendants of anciently immigrated Aryans are still to be found in the province of Constantine and all along the Atlas from Mount Aures to Marocco. Now we send invalids to Algeria, many of its places having obtained the repute of excellent sanatoria!

The Red Indian inhabits the frozen wastes of Hudson Bay and the hottest regions of tropical America. In the Republic of Ecuador he thrives at a height of 12,000 feet on the Andes and in the hot plains at their western base. But if the red man can do this, why is it impossible to the white man, who, according to general opinion, has the greatest facility to accommodation?

The Jews¹⁶ have succeeded admirably in climates very different from that of their native land (Poland, South Africa).

The Spaniards and Portuguese have completely acclimatised in some of the hottest parts of South America. The death-rate of the Spaniards at Cuba is less than in Spain.

The Dutch have prospered in South Africa and in the Moluccas. At the Cape, where they have been settled and nearly isolated for about 200 years, they have hardly changed. They are fair, tall, and robust. Indeed, they are the finest men in the Colony.

MAN'S POWER OF ADAPTATION.

The power of adaptation to a new climate is certainly different in the several tribes of men, but this is not due so much to a superiority in the capabilities of adjustment as to the power and just application of the arts of civilisation. The lower the tribes the more restricted the regions in which they can exist, because they are unable to modify the circumstances which limit their capability of existence.

It has often been repeated that the negro cannot be acclimatised in regions far north or south of its origin; but the negro from Africa has succeeded in America where, especially in the Antilles and in the United States before the war, he was taken care of as valuable property.

The influence of national habits is a most important element in acclimatisation. The Italians, the Spaniards, the Chinese show a great facility of accommodation by reason of their simple diet and quiet, temperate life. The Englishman, on the contrary, is handicapped by his conservative ideas. He cannot give up animal food and spirituous liquors, and he is averse to the slightest change in his mode of life. Prof. Virchow and Dr. Felkin find the success of south Europeans in their element of Semitic blood; but south Europeans can not only endure more heat, but also greater cold. It was remarked by the famous Larrey that Napoleon's campaigns, whether in that of 1806-7 or the later disastrous one of 1812, the troops which endured the cold best were not the northern ones but the southern, such as the Spaniards, Italians, and southern French.

MIGRATIONS OF PRIMITIVE PEOPLE AND MODERN COLONISATION.

Authors generally maintain that sudden transference to an extreme climate is unfavourable to acclimatisation.¹⁷ The ancient migrations of primitive people were accomplished step by step; hundreds of years were employed to gain only a few degrees of latitude. The race thus accommodated itself gradually to surroundings which differed but little from those it had previously left. We proceed in a very different way:

¹⁵ General Duvivier declared, "que les cimetières sont les seules colonies toujours croissantes en Algérie."

¹⁶ It is well to remark that they never cultivate the soil,

¹⁷ Dr. Felkin says, "My strong opinion is that it can only be possible if migration occurs step by step, and in estimating the possibilities of acclimatisation we must count by generations rather than by years."

our railways and steamers transfer us in a few weeks to distances which in old days would have cost centuries. It is only in a few savage tribes that progressive colonisation is still witnessed. I believe that sudden colonisation, "*le grand acclimatement*" as the French have called it, is preferable by far to the "*petit acclimatement*"; and, in fact, what are the losses in our system of colonisation compared with those of the past! The primitive migrations are not recorded by history, but by analogy we may easily imagine how millions of individuals were hurled to destruction in their desperate struggle with men and surroundings. Every step was a battle.

The Kalmouks in their exodus of 1771 were over 600,000 when they left the Volga; but, five months later, only 350,000 reached the frontiers of China.

To fully understand how far more advantageous is a rapid transit, it will be sufficient to point to the first migrations of Europeans to America when they were heaped together for months in the old sailing vessels, or "*floating graves*" as they were called, in which scurvy played havoc.

In 1847, after a terrible famine, 89,738 immigrants left Ireland for Canada; 5,293 died at sea, 10,037 died soon after landing, and of the remainder, 30,265 were diseased.

In the present day we transfer shiploads of emigrants to any part of the world with hardly a single loss, but we land amongst them a host of weaklings. In the old perilous migrations of people only a small minority ever reached the promised land, but they were the survival of the fittest. This was the secret of their success.

RACIAL INTERMARRIAGE.

Crossing with native stock or with immigrants better adapted to the new climate is persistently brought forward by anthropologists as the best and most rapid mode of securing acclimatisation. Intermarriage is said to be the secret of Spanish and Portuguese success in Mexico. But while most authors maintain that half-breeds resist climatic changes better than pure whites (Topinard), others believe that a cross between races is often apt to be a weakling, sharing in the pathological predispositions of each of its parent stocks, while enjoying but imperfectly their several immunities.

Race crossing is present in all colonial populations. Considering only the half-breeds which have resulted from the intercrossing of the white race with the coloured ones, we find that there are over 18,000,000 (D. Omalius). But the human race shows a graduated scale of fertility and permanence in crosses between different types according as they are closely or distantly related. The disposition to union is almost replaced by repugnance in types extremely divergent, while the offspring shows diminished fertility.

Intercrossing is not essential to acclimatisation, and, indeed, many of the most successful examples of acclimatisation have occurred where there has been a complete absence of crossing, as among the Jews in the Bourbon Islands and the Boers in South Africa.

FERTILITY.

It has been asserted that sterility of the white race ensues after three generations in the tropics, and this has become the general opinion, but no direct evidence has ever been

given to prove it (Dr. Fritsche). On the contrary, we have many examples of continued fertility.

The Spaniards, who in their own country have a yearly birth-rate of 37 per 1,000 inhabitants, have one of 41 at Cuba, and one of 46 in Algeria. The French offer a birth-rate of 26 at home, and one of 41 in Algeria.

With plants and animals a sudden change of habitat will sometimes produce a temporary sterility, as with corn at Sierra Leone, geese at Bogota, and European poultry in America. But it soon becomes re-established by spontaneous variation.

RECENCY OF ARRIVAL.

"Recency of arrival" in a tropical country has been considered a most potent condition in predisposing to disease. It is a common belief in several tropical colonies that new arrivals must pass through an attack of a seemingly specific fever which is supposed to be essential to acclimatisation (Rufz). We find a similar belief amongst the ignorant classes of Europe in regard to measles, scarlatina, and pertussis, which are reckoned as inevitable perils of childhood; and I know of mothers who have taken their children to the sick-room of measles so that they should contract the disease, firmly believing that the earlier it developed the milder its course and the healthier the consequent growth of the child.

That a certain functional disturbance should be common among new comers, and that this systematic instability should increase susceptibility to disease is probable, but I believe, with Mr. H. M. Stanley, that the greater immunity of the acclimatised is largely a matter of education in hygienic common sense.

Surely thousands of years of experience have, in many instances, taught the people of tropical countries what is best for them in matters relating to food, clothing, houses, exposure, sleep, and the details of daily life.

The prohibition of pork among the Israelites and Moham-medans, and the general use of hot drinks like tea in China, are based upon the acquaintance with the ill effects that may result from the alimentary use of particular meats and waters.¹⁸

EARLY COLONISATIONS.

The very same difficulties which oppose our colonisation of tropical lands were met by the ancient Greeks when they colonised Sicily and Southern Italy. Malaria was rife in all the places which offered the best commercial prospects. In the monuments which have remained of that wonderful civilisation, we find frequent and unmistakable signs of a great struggle for healthiness. Even the coins of cities such as Caulonia and Selinus have subjects stamped on them which prove the mighty endeavours at sanitation which made their colonisation prosperous.

The same can be said of the old Romans, their great sanitary works, studded all over the ancient world, and in many places still in use, show which are the means of success.

Looking further back, far beyond the records of history, how much more terrible must have been the struggle for life

¹⁸ Herodotus reports that "whenever the great king (Kyros) travels he is attended by a number of four-wheeled cars drawn by mules, in which the water of the Choaspes river, *ready boiled for use* and stored in flagons of silver, is moved with him from place to place."

to the earliest men who, leaving their warm countries, invaded our cold, damp regions, and whose bones we find alongside those of the mammoth, the ursus, and the hyena! Yet they succeeded. Now why should we, retracing our steps, become less vigorous or perish?

MAN WAS BORN IN THE TROPICS.

We know nothing positive about the locality in which the human species first originated, but two important facts lead us to believe that man was born in the tropics.¹⁹ First, the tropics are still the habitat of the anthropoid apes from which the human species evolved according to the unanimous conviction of all naturalists. Secondly, the great civilisations of remote antiquity: Chinese, Egyptian, Chaldean, Assyrian, Hittite, Indian, Persian, Phœnician had their origin in warm countries. The two earliest civilisations of which we can form any definite picture were those which grew up on the banks of the Nile and of the Tigris; they constituted the source whence all peoples have drawn in their turn. The culture of Greece was derived from Egypt and Chaldea, that of Rome from Etruria and Greece, and the Roman style, again admixed with Oriental influences, gave birth in succession to the Byzantine, Romanesque, and Gothic styles, according to the genius of the peoples among whom they were developed. If there be still earlier seats of civilisation whereof the annals remain to be discovered, surely they must be in the South.

I will not go so far as to say that the warmest climate is the most suitable to man under the conditions of modern civilisation, but I must remonstrate against the prevailing idea that a cold and variable climate is the most conducive to the physical and intellectual improvement of the human race. Northern climates certainly produce stalwart frames, but they are not disposed to longevity. The average Arab outlives the average Esquimaux by twenty-five years; the inhabitants of the unhealthy coast towns of South America survive the Gauchos who live a healthy outdoor life; the Hindus attain a surprising age, considering their *penchant* for betel poison and their great poverty. In Europe, the southern nations (Greece, Spain, France) are the most favoured as to longevity. England, with a population of 27,483,490, has 146 centenarians; Spain, with a population of 18,000,000, has 401.

ACCLIMATISATION A MERE QUESTION OF HYGIENE.

Although obliged to greatly curtail the adducible evidence, I venture to hope that the facts set forth in this paper will suffice to prove: First, that European emigrants can live and perpetuate their kind in tropical regions; secondly, that the difficulties in the way of colonisation are not due to climate, but to parasitism; thirdly, that acclimatisation is, to a great extent, a mere question of hygiene.

If colonisation in the past has proved to be a work of mere destruction, it is not a reason to suppose that it must be so in the future. The very failures of the past, if their meaning be clearly apprehended, will prove useful guides. Our greatest achievements are the results of many failures.

Of course, we must not forget that every attempt at colonisation is a campaign not only against man, but against a host of minute living organisms far more fearful.

¹⁹ Max Müller places the locality of human origins "somewhere in Asia."

In last year's expedition to Madagascar, only 7 men were killed by the Hovas and 94 wounded; but the deaths due to disease numbered 6,000, and 15,000 were on the sick list. In the expedition of 1802 to Jamaica, the French lost no fewer than 50,000 out of 60,000 from yellow fever.

The first and most important step towards success is the explosion of the old baneful theories which would only operate by obstructing the adoption of appropriate measures. Europeans going to tropical countries must be of robust constitution and in perfect health. To think that the weaklings and those from malarious districts stand a better chance is an absurd mistake. But physical defects are not the only disabilities; personal habits are of the utmost importance; temperance and morality are powerful weapons in the struggle for life. Arnold was right in saying: "Drink has cost England more graves in the East than all our wars since Clive." Sexual immorality, under the influence of a tropical climate, and in the presence of a native servile and morally undeveloped population, rises to a climax unknown amid the restraints of home life, and becomes one of the most potent causes of physical prostration.

Of the greatest importance is the choice of healthy localities. Even in the most sickly regions there are healthy tracts of greater or lesser extent. The general salubrity of a place may be fairly ascertained from the physical standard of its inhabitants.

The fertility of the land and the conveniences of trade have generally determined the location of settlements on the deadly alluvial soils at the mouth of rivers. Towns thus built in the very worst places in consideration of their apparent value, but totally regardless of their qualities with reference to health, are greatly responsible for the reputation of unhealthiness which is associated with tropical countries.

The sanitation of the unhealthy tracts in tropical lands may seem at first a hopeless task, but intelligence, energy, and science will surely triumph. The genius of man which has united Transcontinental seas and tunnelled mountains, which has changed the course of rivers and made vast regions rainless by denuding them of their forests, which has obliged the earth to produce almost only cultivated plants and domestic animals, and which has grasped the whole globe in a wonderful mesh of electric feelers, can undoubtedly turn to its advantage the vast and rich territories which lie within the tropical belt.²⁰

THE EVOLUTION OF MAN.

Europeans who settle in tropical countries must not expect to remain unchanged from generation to generation. Even when there is no intercrossing, although the main features may persist for a long while, the new surroundings soon give their own print. This is clearly shown by the Jews, who retain their original features, but who also bear the stamp of the country in which they live. In all the Colonies where Europeans have settled, we find they have altered in temperament, ideas, and bodily features. The change is slow at first, because fresh blood constantly streams in from the Mother Country, and perpetuates the original characters, but, as the colony grows older, the immigration lessens, and the new settlers diverge further and further from their original type.

²⁰ The tropical zone comprises more than one-third of the surface of the globe.

We have no reason to dread this evolution, it is the outcome of acclimatisation, and when we consider what splendid races (the Sikh of India, for example) inhabit the most favoured tropical regions, we must come to the conclusion that it can only lead to the development of new people, certainly not inferior to the noblest specimens of existing humanity.

Nevertheless, when we consider that man, modifying surroundings and substituting his selection for that of Nature, has been able to produce endless varieties of domestic animals which would never have come into existence under natural conditions, and would soon revert through atavism to the original type (as witness the wild horse), or perish out of their artificial surroundings, we must certainly believe that he can escape many of those influences which irresistibly modify all other organic beings.

From the moment when the first skin was used as a covering and the first fire blazed at will, man was no longer a slave to the universal evolution, and advancing civilisation will enable him more and more to keep himself in harmony with Nature—not by bodily changes, but by greater strides in intellectual power.